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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/602,395	06/22/2000	John T. Moore	MI22-1384	8705

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WELLS ST. JOHN P.S.
601 W. FIRST
SUITE 1300
SPOKANE, WA 99201-3828

EXAMINER
PHAM, THANHHA S

ART UNIT	PAPER NUMBER
2813	10

DATE MAILED: 05/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/602,395	MOORE, JOHN T.	
	Examiner	Art Unit	
	Thanhha Pham	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 February 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *7,8* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

1. Claims 1-3 are rejected under 35 U.S.C. 102(e) as being anticipated by Hasegawa [US 5,972,800].

Hasegawa, figs 3-11 and col 1-15, discloses the claimed method of forming an oxide region over a semiconductor substrate comprising steps:

forming a nitrogen-comprising layer (3,4, fig 3C) across at least some of the semiconductor substrate; and

after forming the nitrogen-comprising layer, growing an oxide region (7, fig 3D) from the at least some portions of surface of the semiconductor substrate, the oxide region from the at least some of the semiconductor substrate having a thickness of at least about 70 angstroms (col 10 lines 15-25), the nitrogen of the nitrogen-containing layer being dispersed within the oxide region.

2. Claims 1-4 are rejected under 35 U.S.C. 102(e) as being anticipated by Wu et al [US 6,146,948].

Wu et al, figs 1-5 and col 1-6, discloses the claimed method of forming an oxide region over a semiconductor substrate comprising steps:

forming a nitrogen-comprising layer (24, fig 2, col 4 lines 15-40) across at least some of the semiconductor substrate; and

after forming the nitrogen-comprising layer, growing an oxide region (26a, fig 4) from the at least some portions of surface of the semiconductor substrate, the oxide region from the at least some of the semiconductor substrate having a thickness of at least about 70 angstroms (col 5 lines 12-19), the nitrogen of the nitrogen-containing layer being dispersed within the oxide region.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-4 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumo et al [US 6,110,842] in view of Wu et al [US 5,972,800] and Hasegawa [US 5,972,800].

Okumo et al, figs 1-4 and col 1-5, discloses the claimed method of forming an oxide region over a semiconductor substrate comprising steps:

forming a nitrogen-containing layer (fig 1B) across at least some of the semiconductor substrate by plasma niridation ultilizing nitrogen species generated in a

plasma that is at least about 4 inches from the semiconductor substrate for about 0-30 seconds at a temperature of about 0-400oC; and

after forming the nitrogen-containing layer , growing an oxide region from the at least some portions of surface of the semiconductor substrate, the nitrogen of the nitrogen-containing layer being dispersed within the oxide region (see fig 1C).

Okumo et al does not expressly teach the oxide region having a thickness of at least 70 angstroms.

However, the range thickness of the oxide region is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious.

> "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
>
> *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ*

314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time of invention was made would have used any suitable thickness range of oxide region as a matter designed choice. See Wu et al and Hasegawa as examples of designed choice of thickness of oxide regions that is needed in a semiconductor device.

4. Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumo et al [US 6,110,842], Wu et al [US 5,972,800] and Hasegawa [US 5,972,800] as applied in claim 1 above in a further view of DeBusk et al [US 6,140,187].

Okumo et al in view of Wu et al and Hasegawa substantially discloses the claimed method except teaching a usage of a remote plasma nitridation for forming the nitrogen-containing layer. Okumo et al also teaches forming the nitrogen-containing layer by plasma nitridation when the semiconductor substrate is biased or is not biased relative to the plasma.

DeBusk et al teaches that using the remote plasma nitridation is a good method for forming the nitrogen-containing layer with a better control nitrogen amount in the nitrogen-containing layer without damaging underlying layer.

It would have been obvious for those skilled in the art to combine the teaching DeBusk et al to use the remote plasma nitridation in the process of Okumo et al wherein nitrogen species generated in a plasma at least about 12 inches from the

semiconductor substrate and the semiconductor substrate not being biased relative to the plasma during formation of the nitrogen-containing layer.

Moreover, with respect to claims 5-8, range of distance of plasma source to the semiconductor substrate and ranges of time and temperature for forming the nitrogen-containing layer are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art). As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious. See *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).* See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996), claimed ranges of a result effective variable which do not overlap the prior art ranges are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the value of results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA), discovery of optimum value of result effective variable in known process is ordinary within skill of art.

5. Claims 1-3 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghidini et al [US 6,114,203] in view Wu et al [US 5,972,800] and Hasegawa [US 5,972,800].

Ghidini et al, figs 1-2 col 2-3, discloses a method of forming a pair oxide regions over a semiconductor substrate comprising steps of:

forming an oxide layer (24, fig 1) over a covered region of the semiconductor substrate and an uncovered region of the semiconductor substrate by exposing the semiconductor substrate in oxidizing conditions;

removing the oxide layer from over the uncovered region of the semiconductor substrate thereby forming a first oxide region wherein the first oxide region defined by the oxide layer covering the covered region of the semiconductor substrate;

forming a nitrogen-comprising layer across at least some of the first oxide region and across at least some of the semiconductor substrate that is not covered by the first oxide region;

[see col 3 lines 3-13]

after forming the nitrogen-containing layer, growing a second oxide region from the at least some of the semiconductor substrate that is not covered by the first oxide region.

Ghidini et al does not expressly teach the oxide region having a thickness of at least 70 angstroms.

However, the range thickness of the oxide region is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious. See *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA*

1935); In re Dreyfus 24 USPQ 52 (CCPA 1934). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996), claimed ranges of a result effective variable which do not overlap the prior art ranges are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the value of results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA), discovery of optimum value of result effective variable in known process is ordinary within skill of art. Moreover, See Wu et al and Hasegawa as examples of designed choice of thickness of oxide regions that is needed in a semiconductor device.

6. Claims 4-11 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghidini et al [US 6,114,203], Wu et al [US 5,972,800] and Hasegawa [US 5,972,800] as applied in claim 1 or 12 above, in a further view of in view of DeBusk et al [US 6,140,187] and Okumo et al [US 6,110,842].

Ghinidi et al, Wu et al and Hasegawa substantially discloses the claimed method except of specific details of claimed parameters for nitridation including range of distance of plasma source to the semiconductor substrate, ranges of time and temperature for forming the nitrogen-comprising layer by plasma nitridation and a usage of remote plasma nitridation. Regarding using the remote plasma nitridation, forming the nitrogen-comprising layer by the remote plasma nitridation is a well-known technique to form the layer with a better control nitrogen concentration without damaging underlying layer (see DeBusk et al as an evidence). Regarding the range of plasma source to the semiconductor substrate and ranges of time and temperature for forming the nitrogen-comprising layer, the such claimed ranges are considered to are

considered to involve routine optimization while has been held to be within the level of ordinary skill in the art (see Okumo et al discloses the claimed range parameters or the range parameter which is close to the claimed range). As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious. See *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).* See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996), claimed ranges of a result effective variable which do not overlap the prior art ranges are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the value of results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA), discovery of optimum value of result effective variable in known process is ordinary within skill of art.

7. Claims 1-3 and 12-14, as being best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Hasegawa [US 6,091,109] in view Hasegawa [US 5,972,800].

Hasegawa ('109), figs 1-7's and col 1-12, discloses a method of forming a pair oxide regions over a semiconductor substrate comprising steps of:

forming an oxide layer (19, fig 1A) over a covered region (B) of the semiconductor substrate and an uncovered region (A) of the semiconductor substrate;

removing the oxide layer from over the uncovered region (A, fig 1B) of the semiconductor substrate thereby forming a first oxide region wherein the first oxide region defined by the oxide layer covering the covered region of the semiconductor substrate;

growing a second oxide region from the at least some of the semiconductor substrate that is not covered by the first oxide region.

Hasegawa ('109) does not teach forming a nitrogen-comprising layer across at least some of the first oxide region and across at least some of the semiconductor substrate that is not covered by the first oxide region before growing the second oxide region and the second oxide region having a thickness of at least 70 angstroms.

Hasegawa ('800) teaches forming the nitrogen-comprising layer over a silicon substrate or a silicon oxide layer to provide a better oxide region that enables to restrain impurities atoms diffusing into gate insulator to improve reliability of a semiconductor device. Hasegawa ('800) also teaches forming the oxide region of at least 70 angstroms as a matter designed choice.

It would have been obvious for those skilled in the art to combine the teaching of Hasegawa ('800) to the process of Hasegawa ('109) to form the nitrogen-comprising layer and the second oxide region as being claimed to fabricate a good device with a better reliability with reason given above and the thickness of the second oxide region as the designed choices matter when needed in a semiconductor device.

8. Claims 4-11 and 15-16, as being best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Hasegawa ('109) and Hasegawa ('800) as

applied to claims 1 or 12 above, and further in view of DeBusk et al [US 6,140,187] and Okumo et al [US 6,110,842].

Hasegawa ('109) in view of Hasegawa ('800) substantially discloses the claimed method except of specific details of claimed parameters for plasma nitridation including range of distance of plasma source to the semiconductor substrate, ranges of time and temperature for forming the nitrogen-containing layer by plasma nitridation and a usage of remote plasma nitridation. Regarding using the remote plasma nitridation, forming the nitrogen-containing layer by the remote plasma nitridation is a well-known technique to form the layer with a better control nitrogen concentration without damaging underlying layer (see DeBusk et al as an evidence). Regarding the range of plasma source to the semiconductor substrate and ranges of time and temperature for forming the nitrogen-containing layer, the such claimed ranges are considered to are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art (see Okumo et al discloses the claimed range parameters or the range parameter which is close to the claimed range). As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious. See *In re Aller 105 USPQ233, 255 (CCPA). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).* See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996), claimed ranges of a result effective variable which do not overlap the prior art ranges are unpatentable

unless they produce a new and unexpected result which is different in kind and not merely in degree from the value of results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA), discovery of optimum value of result effective variable in known process is ordinary within skill of art.

Response to Arguments

9. Applicant's arguments with respect to claims 1-16 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bowers Charles can be reached on (703) 308-2417. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-3432 for regular communications and (703) 308-7725 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
May 5, 2002

Tuan H. Nguyen
Primary Examiner